Stoichiometry of Electrolytic Cells

① $Q = It$

$= (1.5)(30)$

$Q = 45\ C$

② $t = \frac{Q}{I} = \frac{375}{1.6} = 234.375\ s$

$234.375\ s \times \frac{1\ min}{60\ s} = 3.91\ min$

③ $n_e = \frac{It}{F} = \frac{(1.74)(600)}{(96500)}$ $\quad t = 10\ min \times \frac{60\ s}{min} = 600\ s$

$n_e = 0.0108\ mol$

④ $t = \frac{F \cdot n_e}{I} = \frac{(96500)(0.1)}{(3.5)} = 2757.143\ s$

$2757.143\ s \times \frac{1\ min}{60\ s} = 45.95\ min$

⑤ $t = 35\ min \times \frac{60\ s}{1\ min} = 2100\ s$

$n_e = \frac{It}{F} = \frac{(1.9)(2100)}{(96500)} = 0.0413\ mol$

⑥ $t = \frac{n_e \cdot F}{I} = \frac{(0.146)(96500)}{(1.24)} = 11362.097\ s$

$11362.097\ s \times \frac{1\ h}{3600\ s} = 3.156\ h$

⑦ $t = 20\ min \times \frac{60\ s}{1\ min} = 1200\ s$

$I = \frac{n_e \cdot F}{t} = \frac{(0.015)(96500)}{(1200)} = 1.206\ A$

⑧ $Zn^{2+} + 2e^- \rightarrow Zn(s)$ $\quad t = 10\ min \times \frac{60\ s}{1\ min} = 600\ s$

$n_e = \frac{It}{F} = \frac{(0.5)(600)}{(96500)} = 0.00311\ mol$

$2\ mol\ e^- \rightarrow 1\ mol\ Zn$

$n_{Zn} = n_e \times \frac{1\ mol\ Zn}{2\ mol\ e^-}$

$= 0.00311 \times \frac{1}{2}$

$n_{Zn} = 0.00155\ mol$

$m_{Zn} = 0.00155\ mol \times 65.4\ g/mol$

$= 0.102\ g$ of $Zn(s)$

⑨ $Cr^{3+} + 3e^- \rightarrow Cr(s)$

$$t = 45 \text{ min} \times \frac{60 \text{ s}}{1 \text{ min}} = 2700 \text{ s}$$

$$n_e = \frac{It}{F} = \frac{(54)(2700)}{(96500)} = 1.511 \text{ mol}$$

$3 \text{ mol } e^- \rightarrow 1 \text{ mol } Cr(s)$

$$n_{Cr} = n_e \times \frac{1 \text{ mol Cr}}{3 \text{ mol } e^-}$$

$$= 1.511 \times \frac{1}{3}$$

$$n_{Cr} = 0.504 \text{ mol}$$

$$m_{Cr} = 0.504 \text{ mol} \times 52 \text{ g/mol} = 26.2 \text{ g Cr}$$